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ABSTRACT

Behavior modification techniques were used in teaching reading to 181 disadvantaged Negro third graders. Students were divided into four groups--traditional reading with and without intermediate awards (chips with which they could purchase personal awards) and programed reading with and without intermediate awards. The Sullivan Remedial Reading Program was used for the programed reading groups. Students were pretested and post-tested on the Metropolitan Achievement Tests to compare reading achievement. Data indicated (1) that the traditional reading group with rewards did significantly better than the programed reading group with rewards and (2) that groups with rewards did significantly better than groups without rewards. An interaction effect was found which suggested some reward intrinsic to programed reading. Post-test deterioration of traditional reading students not receiving intermediate rewards was observed. The implications of the study for instructional approaches are discussed at length. Tables, an extensive bibliography, and a list of activities students chose to exchange for chips are included. (AL)

Final Report

Project No. 8-C-048
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MODIFICATION OF THE READING PROCESS BY BEHAVIORAL TECHNIQUES

U. S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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June 1971

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Abstract

Historically, we have been using reading material that is basically inappropriate to the life histories, needs, and backgrounds of many of our beginning readers. This is especially true in regard to most of our preventive and remedial programs which too often are repetitious, a re-hash of classroom "See Dick. See Jane. Run. Run." Teachers in the upper grades (and even in colleges) offer evidence that large numbers of students are unable to read at a level essential to success in their daily assignments. Recent data exemplified by the emphasis given to literacy skills in our country's "War on Poverty" suggests the ineffectiveness of remedial programs to tide the course of wide-scale reading deficiencies. One type of innovation among many in the influx of newer technological methods is programmed reading instruction. Among the claims for programmed reading instruction are that it is suitable for value systems possessed by all types of readers and that materials permit individualized pacing and intrinsic rewards. Another technique recently introduced in education is behavior modification which offers another way to investigate properties of motivation. We need to ascertain what can motivate reading, what sustains pupils' efforts and the valence of various rewards. Once these variables are better understood we will be able to manipulate and increase motivation, proficiency, word knowledge and comprehension.

One hundred eighty one third grade students from their own classes and from Title I geographic areas were separated into four groups:

traditional reading with and without receiving intermediate rewards (with which they could purchase personal rewards) and programmed reading with and without such rewards. A continuous reward schedule was used during most of the data collection period. Data were analyzed by a 2X2 factorial analysis of variance model which tested difference scores.

Results showed significance at or beyond the 5% level for students collecting intermediate rewards over students not receiving such rewards. Traditional reading students with this reward did better than students under conditions of programmed reading with external reward. An interaction effect was found in addition to the main effect and suggested some reward intrinsic to programmed reading. Posttest deterioration of traditional reading students not receiving intermediate rewards was observed.

Increased individualization of instruction and rewards with high personal valence were stressed. Traditional approaches to reading are doomed by advancing technological changes. Freedom and independence for each student in view of contemporary events in the world, including the revolution in our educational system, are discussed at length.

Introduction

Literacy is the most fundamental skill taught in the primary schools. Succinctly stated, literacy provides the key to the acquisition of all other skills, academic and non-academic. The lack of literacy skills on the part of the individual poses a serious, if not insurmountable, barrier to his entire educational and vocational growth and independence.

For the most part the decision as to whether a child will be literate or not is permanently made by the time he completes the sixth grade. (Many contend - and there is evidence to support their position - that for all practical purposes the decision is made by the end of the third grade.) The implications of these facts loom large in the lives of all children entering our public schools; therein the responsibility of our public schools in developing functional literacy skills in the primary grades is paramount.

When considering the disadvantaged child who begins school with a myriad of learning and socio-cultural deficits and problems, these considerations prove all the more awesome. One repeatedly identified problem particularly characteristic of the disadvantaged child is the lack of motivation to learn to read. Many studies have shown all too dramatically that too often the limited motivation which the disadvantaged child brings with him when he begins his academic life is frustrated

and progressively extinguished as he "progresses" through the academic system.

Psychological research has demonstrated repeatedly that learner motivation is indispensable to the acquisition of all skills. Indeed, there is a strong relationship between degree and rate of learning, and learner motivation. Thus, for the disadvantaged child, with regard to the development of literacy skills, motivation is not only the crucial beginning point, it is too often the tragic end point of his academic life.

In recent years many new techniques have been developed for facilitating the teaching of basic literacy skills to the disadvantaged. Some are overly expensive, others overly complex, some, seemingly more feasible. Some have demonstrated a real potential for successfully "saving" the disadvantaged grade school child in the face of mounting illiteracy rates in our urban ghetto schools. However, for reasons not wholly clear at this time, the most promising of these innovations have not been implemented in the classroom on other than a very limited research basis. The majority of public school primary teachers are left to their own ability to innovate in the context of traditional reading instruction. Without the fiscal resources to adopt new curriculum systems and without specialized training in the use of new teaching techniques, the teacher is in effect abandoned along with the disadvantaged child. Thus, with respect to alternative teaching systems and curricula, the teacher is virtually without recourse at the present time (and in the foreseeable future.)

However, one area in which teachers can affect positive change concerns increasing the motivation of the disadvantaged child to learn literacy skills. As the study below indicates, the use of extrinsic reinforcers can have a significant positive impact on the disadvantaged child. Perhaps the most significant point is the fact that teachers of the primary grades can utilize such techniques with the resources already at their disposal.

The use of extrinsic motivators alone will not solve all of the problems faced by the teacher in effectively teaching literacy skills to the disadvantaged child. But it can improve the situation. Most importantly, it can be done in the present pending the availability of the fiscal and technical resources to implement the more promising teaching techniques and curriculum materials developed in the last decade.

The Problem Delineated

Past studies in the field of reading and remediation have worked out of one of several frameworks: they have collated reading deficiency with minimum brain damage, reading and "slow learning," discussed cultural deprivation and lack of opportunity, or paralleled deficiency with some method of repetitious grammar in hopes of remediation. Often there has been little attempt to operational definition, rewards have been vague, and sources of variability have not been systematically varied. We can, therefore, hold little credulity in outcomes derived from such analyses.

Reading is here defined as behavior, akin to other behaviors, and not as "minimal brain damage," "slow learning," or other adjective appellations. Rather than relating deficient reading to brain damage (which is irreversable) or to "slowness," reading can be characterized as subject to the same laws, contingencies, and modes of control of other instrumental behaviors.

By itself, learning to read is not rewarding to young readers, particularly those having difficulty mastering phonetics or word recognition. Historically, we have been using reading material basically inappropriate to the life histories, needs, and backgrounds of many of our beginning readers (Betts, 1957; Bloomfield, 1961; Chall, 1967; Featherstone, H., 1968; Flesch, 1955; Goodman, 1963; Jacoby, 1968; Smith, n.d.; Sullivan, 1967; Woolman, 1966). This is especially true in regard to most of our remedial programs which all too often are repetitious, a re-hash of classroom "See Dick. See Jane. Run. Run."

Once we ascertain what can motivate reading, what sustains pupils' efforts, and the valence of various rewards we can better manipulate and increase motivation, proficiency, word knowledge, and comprehension. Variables which alter motivational dispositions are important in terms of their ramifications.

It should be possible to obtain some measures of the degree of intrinsic motivation in programmed reading systems and therefore be

able to measure the degree to which such motivation can be increased by the application of "token" reinforcement in the spectrum of a programmed approach. A beginning model to be used toward that end is programmed instruction, using chips (in lieu of tokens) as rewards. Indeed, chips might afford a more systematic and objective technique for examining a quality programmed reading technique (Sullivan Remedial Reading Program - known henceforth as SRRP) since this approach would address itself to the question of whether we need some extrinsic reward in conjunction with those already built-in.

It was therefore hypothesized that any suitable programmed reading method employing concurrent chip reinforcement would show an improvement over both a traditional reading technique and over intrinsically-motivating programmed material. Although we don't know all of the specific factors which are operating to motivate the learner in a programmed system, we can determine the relative strength and upper limits of the value of internal motivators in programmed systems by measuring learning progress of subjects who receive no extrinsic motivation and are "left" to the intrinsic motivators of the reading system itself and by utilizing another comparable group of subjects utilizing the same programmed system which is further "enriched" by extrinsic chip reinforcers. A measure of the difference in reading gain rates between the two groups should yield a measure of the relative value of the intrinsic and extrinsic motivators.

With reinforcement externally controlled and systematically varied, we will be better able to study progress made in reading skill than with

regular programmed instruction. The use of an already existing reading program was, for purposes of this investigation, sufficient to test the hypothesis.

A corollary to the major hypothesis was that a quality programmed system would prove superior to traditional reading instruction under all conditions, other factors held constant (i.e., variables such as instructor ability and knowledge and the population comparability are key.) It was anticipated that the magnitude of gain scores produced by chip rewarded programmed instruction would be greater than the magnitude of gain scores obtained through a traditional technique of teaching reading, chip reinforced and non-chip reinforced. The ratio will be altered to the extent to which programmed instruction, as compared with traditional reading techniques, does indeed possess superior internally rewarding properties. It would thus follow that the magnitude of difference in reading systems will be in proportion, albeit greater, to the magnitude of difference in gain scores obtained with the use of chip rewarded and non-chip rewarded traditional reading techniques.

Thus, although there are no apparent means of obtaining a measure of the absolute value of intrinsic motivators inherent in programmed reading systems, an objective indirect measure can be derived by obtaining the difference in reading gain scores achieved with the use of a non-chip reinforced traditional reading technique and a programmed reading system. Higher gain scores obtained with traditional reading techniques would

imply relatively low valence of intrinsic motivators in the programmed system employed. Conversely, higher gain scores obtained with a programmed system would indicate a relatively high valence of the intrinsic motivators in the programmed reading system.

Method

Relevant Variables and Their Control

Reading gain score, vocabulary change, and word knowledge were the dependent variables. Intellectual change was also measured.

Traditional reading instruction with and without chip reward and programmed reading with and without chip reward were the independent variables. Kind of instruction and type of motivation were manipulated variables.

Age, intelligence, socio-economic status, and reading level were important variables for consideration. Because the selection of students in Title I classes was an administrative decision, in samples drawn, age and socio-economic status were controlled by their placements. Variation existed in intelligence and reading level.

Data Collection Techniques

To evaluate reading gain scores, written and oral group achievement tests with word fluency (i.e., vocabulary) and word knowledge were employed. The Metropolitan Achievement Tests (MAT) satisfied these criteria. The Otis Quick Scoring Mental Ability Tests (OT) were utilized to measure intellectual change.

Subjects

Students (Ss) resided in Title I geographic areas. They were approximately of the same age (8-11) and had disparate intellectual

functioning and reading levels which were randomly distributed. Through class placement, age and social class were empirically controlled. Sex was controlled by inspection.

Students in a public school system were employed (a total of four separate classes). The Ss were all from low income, deprived families and were predominantly Negro. Size of class was balanced in number.

Procedure

All Ss were administered the Word Knowledge, Word Discrimination, and Reading subtests of the MAT. In addition, they were given the Non-Verbal portion of the OT. Ss to be involved in SRRP were also administered the Sullivan Placement Test so that the programmed reading groups could be placed in the appropriate notch in the program. Order of presentation was MAT, OT, and Sullivan tests with rest intervals after approximately 45 minutes of work. Less than two hours was required to complete both pre- and posttesting batteries.

Students were randomly assigned by method. The pupil-teacher ratio was the same with comparable years of experience for teachers. Each method (programmed and traditional reading and chip and non-chip groups) was assigned a number. Numbers were put on a sheet of paper and placed in a box. Method of instruction was put on the blackboard. Numbers picked out of the box were assigned a reading method in descending order. At the onset, each of these four groups contained slightly less than 50 Ss; with attrition, the final count was N=181. Half the group

(i.e., two classes) received traditional reading and half (two classes) programmed instruction. Furthermore, two classes (i.e., one using traditional and one using programmed instruction) received chip reward (thus, there were 92 receiving chip reward and 89 not receiving it).

The experimenter (E) introduced himself to each class of students as a student himself trying to develop a "game" as a homework task. After rapport was established Ss were told the nature of the "game".

Poker chips (in place of tokens) were used as intermediate reinforcers for Ss to "buy" rewards desired (Appendix 1). Plastic discs often used in card games served this purpose. Only white chips were employed because of possible emotional factors relating to colored chips. The ability of each S to buy what he individually chose assured a high strength associated with chips received.

Rewards desired were not to take more than 2-3 minutes of class time to complete and had to be feasible according to the teacher. Choices covered a myriad of possibilities. Chip getters obtained one chip after completion of each page of work--oral or written--in their respective books.

An adjusting schedule technique, of use with so-called culturally disadvantaged students, was attempted (Berman, 1967). As such, after a period of continuous reward given chip getters after each page of work, teachers were to switch to an intermittent schedule with fixed ratio reward (every two pages) in an effort to maintain the behavior. Time did not permit extensive investigation of this schedule alteration.

After collecting five chips, saved at their desks, Ss turned in their chips for immediate expression of one of their professed choices. After this period they returned to their work.

Each class was occupied with "reading" for less than an hour five mornings a week. The traditional reading groups went through their work in their customary manner. Teachers using programmed materials were instructed in the technique by a consultant.

Statistical Methodology

The experimental variables were the kind of instruction and the type of motivation. A total of 181 Ss were employed. There were 92 Ss who received chips (46 in both traditional and programmed reading) and 89 who did not receive chips (46 in traditional reading and 43 in programmed reading).

There were four sets of comparisons in this 2X2 dimensional analysis of variance of difference score model (post minus pretest score) with 2 levels at each dimension (Guilford, 1966). Analysis of variance was completed for Word Knowledge, Word Discrimination, Reading, and intelligence.

Results

Each of the four main variables (Word Knowledge, Word Discrimination, Reading, and intelligence) was analyzed by a two-dimensional fixed-constants analysis of variance model under these conditions: equal, unequal-proportionate, or unequal-disproportionate; equal or unequal-proportionate; and unequal disproportionate (adjusted-least squares solution). Row effects corresponded to method of instruction (traditional reading and programmed reading) and column effects to mode of reward (chip and non-chip conditions).

In the case of Word Knowledge there was a significant difference ($p < .01$) between chip and non-chip conditions ($F=35.94$, $df=1$). There was also a significant interaction ($p < .01$) between chips and reading method ($F=7.00$, $df=1$) as seen in Tables A and B.

Inspection of the overall means for the differences for method of instruction and mode of reward indicates that Ss under conditions of traditional reading responded more significantly to the use of chips than did Ss receiving programmed instruction. Under non-chip conditions traditional reading Ss did poorer in posttest than they had in pretest measures on Word Knowledge. Under conditions of no chips, programmed instruction Ss did better than traditional reading Ss.

Experimental results of Word Discrimination are presented in Tables C and D. Analysis of the mean differences in these Tables shows a significant difference ($p < .01$) between chip and non-chip rewards ($F=21.01$, $df=1$) and a significant interaction ($p < .01$)

between chip conditions and reading method (F=9.40, df=1).

Table D shows that Ss under conditions of traditional reading did better with the utilization of chips than did Ss receiving programmed reading. Under conditions of no chips, programmed instruction Ss performed better than traditional reading Ss. Again, in posttest, non-chip traditional readings Ss did poorer than they had in pretest in Word Discrimination.

The analysis of variance for Reading is reported in Table E and the means and standard deviations of difference scores for this data in Table F. The analysis of variance shows that the difference due to method of instruction (F=5.07, df=1) and to mode of reward (F=12.88, df=1) were both significant ($p < .05$ and $p < .01$ respectively). Moreover, the variance due to interaction between method of instruction and mode of reward was significant (F=10.40, df=1, $p < .01$). Non-chip traditional readers did poorer in posttest than in pretest in Reading. Observation of the mean differences shows that chip conditions are better predictors for change in Ss receiving traditional reading than for Ss under conditions of programmed reading.

The test for significance for intelligence failed to attain significance.

In Word Knowledge, Word Discrimination, and Reading, Ss under conditions of no experimental manipulations (i.e., the non-chip, traditional readers) showed a decrease in performance as compared to traditional readers receiving chips and to programmed reading Ss both receiving and not receiving chips.

Discussion

Findings

The results clearly demonstrate the superiority of personalized external rewards accompanying both traditional and programmed methods of reading instruction used by Title I third grade students. Moreover, a traditional reading method is more sensitive to the inclusion of an external reward than is a programmed reading method. In addition, there is an interaction effect between reading method and mode of reward with each acting on the other. When left to proceed with a traditional course of reading development, both disabled, average, and superior readers evidence deterioration of skills involved in word knowledge, discrimination, and reading comprehension. There seems to be some intrinsic reward basic to a quality method of programmed instruction. The research provided evidence which suggests that programmed reading can prove an even greater aid to improvement of word knowledge and verbal comprehension when paired with personalized external rewards. Intelligence does not appear to be altered under conditions of programmed or traditional reading with and without chips.

Intelligence was included as a post hoc variable. Its subsequent absence of statistical significance was anticipated since: (a) intelligence was controlled by randomizing the samples by age, grade placement, sex, intelligence, and, (b) since intelligence was equally distributed among the samples, it was conjectured that there would be no differential

effect by treatment (i.e., method of instruction and mode of reward) as a function of intelligence.

The major hypothesis (which posited an improvement for students using a programmed reading method with chip reward over students using methods involving traditional reading or programmed reading without chips) was confirmed. The corollary (which hypothesized the superiority of gain score for students using a programmed reading approach over traditional reading approach, other factors held constant) was not confirmed. The degree of effect of chips varied as a function of reward conditions with students in non-chip conditions showing less improvement than chip-rewarded programmed and traditional reading students. Interaction of reward conditions helped determine the effectiveness of the reading approach with traditional reading students benefitting more than students using programmed reading.

Implications

As a concommitant to reading, rewards that have strong personal valence--chips, as "token" or intermediate rewards--may offer a unique vehicle for satisfaction to students at any level in the academic ladder. Rather than a substitute for rewards which may be products of teachers' perceptions, chips represent a way of securing rewards that are in the repertoire of needs of the learner. Too often teachers' hunches of satisfying activities for students are irrelevant or otherwise inappropriate to their perceived needs. Moreover, offering rewards with strong

valence to students insures greater personal involvement in learning. This problem may be taken care of by permitting students to determine the nature of their rewards.

The acquisition and purchase of reward with chips helps to introduce students to the economic structure of American society. Further, once the behavior under investigation is established, such intermediate rewards can be phased out and direct reinforcers substituted. Thus, chips serve as an expedient means to an end.

Intermediate rewards provide a consistent and systematic technique for fashioning increased motivation and, subsequently, open the door to greater understanding of basic skills necessary in the process of reading (cf. Betts, 1957). Further chips can be given immediately without disrupting on-going activities (i.e., learning) in the classroom. By providing for rapid payoff for collected chips, students find that they may get to do what gives them pleasure without waiting for approval from others: teachers or peers. Their immediate knowledge of results coupled with their awareness of their own progress may have assisted their increased proficiency in verbal skills.

An excellent way to insure that students will attend to feedback as a form of reinforcement is to make it positive (cf Smith, "Partial Revision of Manual," p.53). Chips (tokens, money) gained, therefore, for achievement should not be taken away for task failure. While a student may attempt a task several times before completing it success-

fully, when he has succeeded, he should be given his "token" reward. In this way, a previous failure does not discount a final success.

At a broader level, it has long been recognized that, to a major degree, the educational problems of the disadvantaged citizens of the community result from the inability of our educational institutions, public and private, to adequately meet their educational needs. For better or worse, the bulk of our technical educational resources are presently committed to an existing institutional structure and are likely to remain so for the forseeable future. In many respects this probability raises the frightening question as to who really constitutes the culturally disadvantaged--those children who succeed and are thus indoctrinated by the system, or those children who fail to achieve as programmed by the system and thus retain their personal and cultural identity and integrity.

Several attempts have been made to establish "extra-institutional" programs to cope with the needs of the disadvantaged. Some of these community-based programs have experienced a degree of success; others have met with less favorable results. However, one point is clear--our educational system has an infinitely greater capacity to turn out larger numbers of poorly educated, functionally illiterate, and otherwise educationally-handicapped individuals than we will ever have the capacity to handle through extra-institutional programs even if they all functioned as quality programs.

Thus, if we are to make progress against an increasing stream of educationally-handicapped individuals pouring out of our institutional

structures we must work to change those institutional structures to stem the flow of educationally handicapped individuals from them and to retrieve as many educationally handicapped individuals as possible through improved basic and remedial education programs.

The areas of greatest need in our public and private schools involve training (or retraining) teachers to better work with the disadvantaged. Greatest concern should be concentrated on developing new, more functional methods of instruction and on training programs to teach such methods to school teachers. Another major concern should be the development of special (i.e., remedial) programs for the individual who is two or more years academically retarded, the potential dropout, and the dropout. Programs for the school dropout and individuals over 16 years of age who are in school but whose performance level is more than two years below grade level should also include adequate preparation for passing the high school equivalency examination.

In addition, special attention must be devoted to the needs of the younger child entering the educational system. It is during the critical first three years in school that the system has its greatest impact on the child--whether or not he will be literate and an educated graduate, or an illiterate dropout into ignorance and poverty. Special efforts must be undertaken to assure that these first three years of the educational process are successful and lay a firm foundation of basic learning skills which will assure positive upward movement and success through the remainder of the educational process.

Lastly, the myriad of weaknesses presently rampant in our educational system argue strongly for a fundamental reassessment of our educational goals, objectives, and standards. The fact that these conditions have prevailed as long as they have raises grave questions in this regard.

Replication

Certainly, problems inherent in quality programmed reading methods need correction. However, one must be careful to distinguish between problems resulting from poor use of programmed techniques, measures of success of the technique, and the value of the technique itself. Among the problems of programmed reading methods, as Lysaught (1967) points out, are the need for techniques for examining internal validity. The problem of what criterion measure to employ is another. Existing tests of achievement contain system-bias in favor of traditional systems. Standardized achievement tests are inappropriate and producers of such tests are lax in not preparing structurally statistically-sound tests to measure gain in reading with usage of their materials (see Schramm, 1964).

To replicate this study, attention should be paid to the work of Schramm (1964) and Lysaught (1967) which implies the need to develop alternate forms of criterion tests of programmed materials. Hence, one might consider, as one approach to developing criterion tests (and an alternate form for each), enumerating two lists of words from

those words contained in programmed materials which would be used in designing new tests and which could gauge whether students do indeed learn under conditions of programmed reading. To that end, a revision of test design to measure efficiency of progress in programmed materials is offered (Table G).

Time did not permit alternation of scheduling. Therefore, at least six months should be allowed for data collection so that intermittent schedules of chip-reinforcement can be utilized subsequent to establishing a base-line of response under conditions of continuous reinforcement (see Berman, 1967).

Teachers should not be permitted to disrupt a prescribed reward system by giving or taking chips based on student activity unrelated to reading (e.g., talking out of turn, coming to class late, fighting, etc.) as defined in the research design. Such behavior on the part of the teachers results in aversive or escape conditioning wherein students engage in behavior to avoid reprobation from their teacher. Teachers should not base the granting of chips on student activity which is irrelevant to behaviors specified in the systematic development of reading skills. Unproductive talk about chips should be avoided on the part of teachers. They should avoid mentioning chips and routinely give them when proper work is done. They should not be given if requested by the student or held up by the teacher as a payoff. Presentation of chips might be accompanied by general verbal statements of approval such

as "good," "you're doing fine," etc. Students should not be permitted to keep their chips at will but should be required to turn them in when collecting their rewards.

The practice of allowing students to accumulate chips from day to day may produce some uncontrolled variability by allowing them to work hard one day without receiving immediate reward or conversely to invest little effort and yet reap rewards by using chips earned on previous days. Hence, rewards should be given based on a fixed schedule for appropriate responses and collected and exchanged frequently for personalized rewards. As soon as five chips are accumulated they should be turned in to the teacher so that students can collect their rewards. A defined universe of reward choice might be developed including academic and non-academic rewards. Comparisons of such rewards may be made with pre- and posttest measures.

Substitute teachers working with any students in the program should be informed of the procedure followed in their class to assure continuity and integrity of the research design. Untrained assistants, teachers, or helpers should not be permitted to engage in this program until orientation and indoctrination are complete.

One factor noted in the literature (Betts, 1957; Schramm, 1964) which may be relevant in replication concerns the deleterious effects of having female teachers working with classes populated primarily by

boys. To Betts, boys comprise from 60-80% of the retarded reading population. Although the problem of sex differences is not fully understood, observations and data collected indicate: (a) in some areas girls are promoted on lower standards of achievement than are boys, (b) there is a need for reading materials (especially in the primary grades) written to stimulate and challenge the interests of boys, (c) girls use reading in their play activities more than do boys, (d) there is a need for additional male teachers in the elementary schools, and (e) on the average, girls mature earlier than boys in certain functions involved in reading. Hence, the literature suggests the need for more male instructors as well as materials more suitable to male students.

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TABLE A

ANALYSIS OF VARIANCE—WORD KNOWLEDGE

Source of Variation	Mean Squares	df	F
Method of Reading	2.82	1	.14
Mode of Reward	742.62	1	35.94**
Interaction	144.65	1	7.00**
Within Sets	20.66	177	

**p<.01

TABLE B

MEANS AND STANDARD DEVIATIONS

OF DIFFERENCES—WORD KNOWLEDGE

	Chip	Non-Chip
Traditional Reading	$\bar{X}_D = 4.50$ $SD_D = 4.94$	$\bar{X}_D = -1.30$ $SD_D = 4.52$
Programmed Reading	$\bar{X}_D = 2.43$ $SD_D = 3.60$	$\bar{X}_D = .19$ $SD_D = 4.81$

TABLE C

ANALYSIS OF VARIABLE—WORD DISCRIMINATION

Source of Variation	Mean Squares	df	F
Method of Reading	22.42	1	.97
Mode of Reward	485.21	1	21.01**
Interaction	217.15	1	9.40**
Within Sets	23.09	177	

**p<.01

TABLE D

MEANS AND STANDARD DEVIATIONS

OF DIFFERENCES--WORD DISCRIMINATION

	Chip	Non-Chip
Traditional Reading	$\bar{X}_D = 3.93$ $SD_D = 5.44$	$\bar{X}_D = -1.50$ $SD_D = 5.74$
Programmed Reading	$\bar{X}_D = 2.41$ $SD_D = 3.90$	$\bar{X}_D = 1.40$ $SD_D = 3.43$

TABLE E

ANALYSIS OF VARIANCE--READING

Sources of Variation	Mean Squares	df	F
Method of Reading	93.81	1	5.07*
Mode of Reward	238.43	1	12.88**
Interaction	192.49	1	10.40**
Within Sets	18.51	177	

*p < .05

**p < .01

TABLE F

MEANS AND STANDARD DEVIATIONS

OF DIFFERENCES—READING

	Chip	Non-Chip
Traditional Reading	$\bar{X}_D = 3.22$ $SD_D = 4.33$	$\bar{X}_D = -1.11$ $SD_D = 4.50$
Programmed Reading	$\bar{X}_D = 2.57$ $SD_D = 4.14$	$\bar{X}_D = 2.42$ $SD_D = 4.02$

TABLE G

MODEL PROCEDURE FOR EVALUATION OF TRADITIONAL AND PROGRAMMED READING WITH AND WITHOUT CHIPS[a,b]

Group	Pre-Test	Instruction	Post-Test	Retention Test
I	X	Traditional Without Chips	X	X
II	X	Programmed Without Chips	X	X
III	X	None	X	X
IV		Traditional Without Chips	X	X
V		Programmed Without Chips	X	X
VI		None	X	X
VII	X	Traditional With Chips	X	X
VIII	X	Programmed With Chips	X	X
IX	X	None	X	X
X		Traditional With Chips	X	X
XI		Programmed With Chips	X	X
XII		None	X	X

[a]Modified form of the Solomon-Four-Group Design used for research purposes on self-instruction at the Univerisity of Rochester (Lysaught, 1967, p.8).

[b]This design permits control for all internal sources of invalidity including: maturation, selection, experimental attrition, regression, and instrumentation. Moreover, it can control other sources of external validity such as interaction of testing and the experimental variable and the interaction of selection and the variable.

Appendix 1

Chip Getters' Choices for Activities

Collected at Random

Clean the classroom.

Fix the shelf.

Draw a picture.

Help teacher.

Get a drink of water.

Color.

Look at a book.

Look at the globe and study it.

Sweep the floor.

Erase the board.

Be in charge of the paper the teacher passes out.

Write on the board.

Pass out seatwork.

Clean out desk..

Carry teacher's bookbag.

Sit in the front of the class.

Open the windows in the morning.

Help put things on the board and decorate the room.

Be teacher for 5 min. (sic).

Sing.

Take names of talkers in laboratory.

Play a quiet game.

Sit on the floor.

Play games.

Study various subjects.

Water the flowers.

Draw, paint, and color.

Help others with their assignments.

Aid in putting up bulletin boards.

Study the maps and globe.

Make things of various materials.

I would like to play fun game.

I would like to do more work.

I would play bus driver.

I would like to act out a story.

I would like to read stories.

Pretend I'm driving a bus.

Read a story.

Play with my pencil.

Write a story.

Draw a picture.

I would like to draw a picture that only take (sic) 20 minutes.

I would want to read a story that only take (sic) 15 minutes to read.

I would want to ask my teacher to let us work on Science.

I would (sic) to clean the room up.

I would like to open skool (sic).

I will like to read books.

I will like to play a game.

I will like to go to the library.

I will like to make a picture of a house.

I will like to make a funny girl.

I would like to draw a picture so that they could hang my picture up.

I would like to play like I am queen of England.

I would like to sing a song to the class.

I would like to play jacks.

I would like to have a game that I could play by myself.

I want to read a book.

I would like to draw a truck.

I would like to play with the flash cards.

I would like to said (sic) the abc.

I would like to write a story.

I would read my book.

I would like to play with sentence builder.

I would play with the arithmetic flash cards.

I will colors (sic) in my room.

I would like to sing a song.

Play games.

I like to color.

I like to draw.

I like to sing.

I like to play.

I like to play a game.

I like to read books.

I like (sic) draw.

I like to color.

I like to be the king of the room.

I would like to play.

To colors in the room (sic).

I would like to help Mrs. Vallin.

I would like to cneck the work.

Do no work.

Draw a picture for the class.

Read a story to the class.

Be in charge.

Collect the homework.

Help correct seatwork.